Facts about ROOF INSULATION

THE INSULITE CO.

Builders Exchange Bldg. Minneapolis, Minn.

Facts about ROOF INSULATION

Extract from U.S. Bureau of Standard's Publication—
Technical Information on Building Materials No. 39, Nov. 24, 1936

Bituminous built-up roofing is particularly adaptable for flat roofs such as are usually found on hotels, apartment houses, industrial buildings, etc., but has also been used to considerable extent on smaller structures where low pitch roofs are desired. It may be applied to roof decks of wood, poured concrete or gypsum, precast concrete or gypsum blocks, book tile and steel, and when properly constructed should give long service with but little attention. Insulation may be incorporated with built-up roofing on any of the above mentioned deck types.

CONTENTS

Facts About Roof Insulation .... Page 2
The Advantages of INSULITE Roof Insulation .... Page 3
Introduction to Specifications—A Guide to Good Practice .... Page 4
Specifications for Application over Poured Concrete or Gypsum Decks .... Page 5
Specifications for Application Over Steel Decks .... Page 6
Specifications for Application Over Wood Decks—High Humidity Not a Factor .... Page 7
Specifications for Application Over Wood Decks—High Humidities .... Page 8
Specifications for Application Over Steep Roofs .... Page 9
Alternate Specifications .... Page 10
Thermal Coefficients for Various Types of Roof Construction .... Pages 11 and 12
Fuel Savings Analysis of a Typical Industrial Roof .... Pages 13 and 14
Explanation of Fuel and Radiation Requirements Chart .... Page 15
Fuel and Radiation Requirements Chart .... Page 16
Prevention of Condensation .... Pages 17 and 18
How to Use the Condensation Chart .... Page 19
Condensation Chart .... Page 20
A Few Representative Roofs Insulated with Insulite .... Page 21
List of Insulite Structural Insulation Products .... Page 22

INSULITE
THE *Original* WOOD-FIBER INSULATION BOARDS

Facts ABOUT ROOF INSULATION

A good roof will provide more than protection from rain, snow and hail. It will be a barrier against excessive loss of valuable heat in winter and reduce the penetration of the heat from "sun effect" on the roof in summer.

Modern science has shown that there is scarcely an industry, but should maintain regulated conditions of temperature and humidity within their structures. Heat losses through uninsulated walls and roofs make it either impossible or uneconomical to maintain ideal working conditions. Much progress has been made in recent years, toward preventing these losses with tighter construction, weatherstripping, and multiple-glazed windows. The efficiency of heating plants has also been greatly increased.

ECONOMY

These improvements, however, are futile if the roof is insufficiently insulated. We might liken such a building to an uncovered gasoline tank which has been repaired by plugging some holes in the sides and bottom, but the top left open. The gasoline will continue to evaporate through the top. Heat rises, thereby tending toward greater heat loss through the roof than the walls. Consequently it is essential that the roof be as heat-tight as practical.

The economy resulting from insulation increases as the sources of heat supply decrease. The higher the cost of fuel and the more rigid the requirements for temperature and humidity control, the greater will be the savings resulting from proper insulation. A properly insulated roof will check the wasteful loss of heat through the roof, just as a tight lid on a gasoline tank prevents evaporation of its contents.

PREVENTION OF CONDENSATION

The problem of moisture condensing on roofs and ceilings is often as serious a problem in industrial buildings as that of heat loss. The constant accumulation of moisture on the structural members of a roof is not only an inconvenience but will eventually necessitate replacement of part or all of the roof, because of rot or rust.

Condensation will occur on any surface, cooler than the Dew Point temperature of the air in contact with that surface. Insulite Roof Insulation products retard the passage of heat through the roof and thus the temperature of the inside surface will be kept more nearly equal to that of the air in contact with it. This makes it possible to maintain a higher relative humidity within a properly insulated structure without the presence of free moisture. (See "The Prevention of Condensation," pages 17 and 18.)

ADVANTAGES OF ROOF INSULATION

A properly insulated roof will continue to pay dividends in annual fuel savings for the life of the building. In addition, less installed radiation will be necessary to heat such a building. This represents a direct saving in the cost of radiation equipment to be installed. These, together with better working conditions, because of ablity to maintain proper temperature and humidity, without the presence of condensation which may be the cause of costly upkeep and depreciation are some of the advantages of proper insulation.

Another advantage gained by proper insulation in the roof is the effective stopping of the transmission of the heat from the sun's rays in the summer. This is a problem common to all parts of the country where black surfaced, flat roofs are used. The hotter the climate, the more essential and the more advantageous is the use of sufficient insulation.

There are still other important advantages aside from the insulating value of roof insulation. The manufacturers of steel roof decking and roofing materials, both stress the necessity of insulation between the steel deck and the built-up roof. If the roofing were applied directly to the steel deck, it would buckle and warp due to the expansion and contraction of the steel with temperature changes. Severe changes in temperature also cause checks and cracks in concrete decks. Insulite prevents extreme changes of temperature from reaching these materials and thus provides a constantly smooth base for the built-up roof.

INSULITE--IDEAL INSULATION PRODUCTS

Light, fibrous or cellular materials are the perfect heat insulators. Insulite Roof Insulation products are of this type. They are made from fibres of carefully selected northern woods, felted together so as to form millions of air cells, each cell sealed from the other so that air currents cannot become active between them. Insulite Roof Insulation products have been doing their work efficiently since 1914. Insulite Roof Insulation products fulfill all requirements of the U. S. Dept. of Commerce Commercial Standards Specification CS-42-35 and the Federal Specification LLL-F-321a, covering material acceptable for federal government jobs.

On succeeding pages we present and explain charts and tables of inestimable value to you in determining fuel and radiation savings and proper thickness of Insulite to use in order to reduce heat transmission and prevent condensation on your roof.

THE ADVANTAGES OF INSULITE ROOF INSULATION PRODUCTS

Ins-Light Roof Insulation and Graylite Roof Insulation were developed by The Insulite Company after extensive research and long time field experience, as ideal insulating materials for roofs. Both are made from the same basic wood fibers and felted into board form in a similar manner. However, the fibers of the Graylite Roof Insulation are treated with bitumen during the manufacturing process so that the bitumen is uniformly distributed throughout the material and is an integral part of the board. This provides added strength and resistance to moisture, making it highly suitable for all types of roof construction, especially where high humidities may be encountered.

Both types are made in units 22″ x 47″, in the same thicknesses and the same types of edges as follows:

THICKNESS	FABRICATION	TYPE OF EDGE
½″	Integral	Square
1″	Integral	Square
1″	Integral	Shiplapped
1½″	Multiple layers, cemented	Square
1½″	Stapled, spot cemented	Offset
1½″	Multiple layers, cemented	Shiplapped
2″	Multiple layers, cemented	Square
2″	Stapled, spot cemented	Offset
2″	Multiple layers, cemented	Shiplapped

Square edged roof insulation will be satisfactory where 2 layers are to be used, inasmuch as the joints of the two layers can be broken so that there are no through joints. However, when the job requires but one layer of insulation, the shiplapped or offset edges are preferable.

Some of the advantages of Insulite Roof Insulation products in their various types and forms are as follows:

1. *Offset or shiplapped* edges provide broken joints all around each sheet so that all edges are completely heat sealed.

2. *Easy handling and speedy application* are made possible. The standard 22″ x 47″ size is small enough to handle easily and large enough to cover rapidly.

3. *There is practically no loss through breakage* when using Insulite due to the strength and rigidity of the material. This is particularly true of Graylite Roof Insulation, because of its greater tensile strength.

4. *Less pitch or asphalt* is needed to provide a uniform water-proof mopping and a better bond with the insulation is possible by using Graylite Roof Insulation, because of the integral bituminous treatment of the board.

5. *A smooth, rigid base,* ideal for the application of roofing is formed when the strong units of Insulite Roof Insulation, machine trimmed to accurate thickness and dimensions, have been laid, smoothing out minor irregularities of the deck surface.

6. *Roofing can be laid quickly* on a base of Insulite. It can be laid with equal ease over any type of deck; wood, concrete, steel or tile. (See specifications for application over various types of roof construction.)

7. *It will save money* on any type of roof, both in first cost and in fuel saving every succeeding year.

8. *Efficient working conditions* can be provided for all industrial plants because proper temperature and humidity conditions can be maintained without condensation in a building insulated with the correct amount of Ins-Light Roof Insulation or Graylite Roof Insulation.

Insulite Roof Insulation Over Concrete Deck

ROOF INSULATION SPECIFICATIONS

Introduction—A Guide to Good Practice

GENERAL

Any irregularities or defects in the roof construction that will prevent the proper application of the roof insulation should be checked and reported to the architect or to the general contractor in advance.

CONDITION OF DECK

No portion of the insulation or built-up roofing shall be applied until the roof deck has been given time to thoroughly season, is dry and smooth.

SEAL COURSES

The seal course is a continuous membrane of felt or water-proof paper laid over the deck prior to the application of insulation. (See specifications for various types of roof decks regarding the type of paper and method of applying.)

Where high humidities are maintained, beneath a wood deck, a water-proof seal course is particularly necessary (see page 8). The United Roofing Contractors Association recommends the use of water-proof seal courses under insulation over *all* concrete and wood decks because of the probability of change in use of any building.

Insulite Roof Insulation Over Wood Deck

On all insulated masonry roof decks, a seal course consisting of 2 plies of 15-pound felt mopped to the deck is desirable, due to the protection it provides from inclement weather prior to laying the insulation and from the penetration of moisture into the insulation from a green or wet slab after heat is applied to the under side.

WATER CUT-OFFS

Water cut-offs are standard in good construction. They provide assurance against spread of leaks from unforeseen causes or damage to the water-proof covering over the insulation. They also protect the edges of the insulation left at the end of a day's work from over-night or week-end showers. The use of square edged roof insulation will facilitate application of water cut-off strips.

WOOD NAILING STRIPS

Insulation is not a nailing base. Therefore, it is necessary that wood nailing strips be provided for attachment of sheet metal flashing. These strips should be the same thickness as the insulation and should be at least 1″ wider than the apron of the flashing.

The general or carpenter contractor should furnish and install these nailing strips.

RECOMMENDED NUMBER OF LAYERS

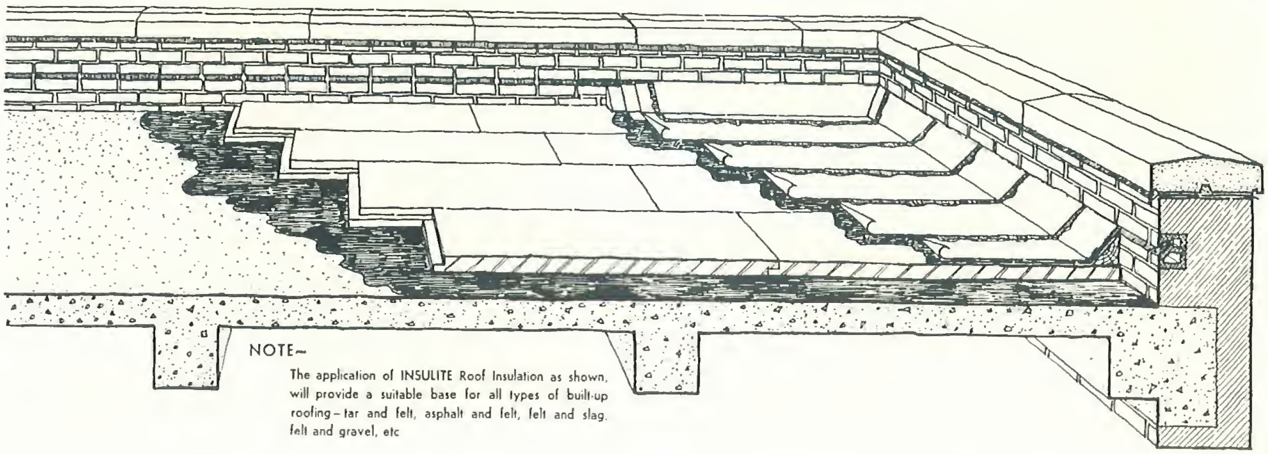
Insulite Roof Insulation Products are made with both offset and square edges in all thicknesses except ½″, which is square edged only. Where square edge units are used, for best results, the insulation should be laid in two layers, the second breaking joints with the first layer.

BITUMENS AND FELTS

Unless otherwise specified, coal tar pitch (see Fed. Spec. R-P-381) or asphalt products (see Fed. Spec. SS-A-666) of reputable manufacturers may be used. Felt should be impregnated with asphalt when used with asphalt mopping; when coal tar pitch mopping is used, the felts shall be impregnated with coal tar pitch.

PREFACE TO SPECIFICATIONS

The specifications are given as a guide to good practice for use under normal conditions. For out-of-the-ordinary conditions, upon request the Engineering Department of The Insulite Company is available for advice and recommendations regarding these special cases.



SPECIFICATIONS FOR APPLICATION OVER
Decks of Poured Concrete or Gypsum or Tile Under Built-up Roofing or Promenade Tile

PREPARATION OF DECK

Sweep deck clear of rubbish and see that it is dry and smooth.

(a) *Unit Tile Deck.* The joints of all the tiles shall be properly pointed up.

(b) *Under Promenade Tile.* The drainage slopes may be provided either by proper grading of the roof slab before laying the Insulite or by built-up slopes over the Insulite and under the promenade tile and its mortar bed.

(c) *Priming the Deck.* Prime the deck with asphalt roofing primer. (If coal tar pitch and felts are used, no primer is necessary.)

APPLICATION OF INSULATION

(a) *General.* Lay only as much Insulite each day as can be covered by the finished roofing that day. Abutting edges shall be brought to moderate contact and end joints in each course shall be staggered with those of adjoining courses.

(b) *Mopping and Laying the Insulite.* Over monolithic slab construction the mopping shall be continuous. Over a roof of individual tiles or roof planks such individual units shall be spot or strip mopped. Mop the deck liberally with bitumen (minimum, 25 pounds per square) covering only sufficient area to provide complete embedment of one Insulite unit at a time. Lay Insulite Roof Insulation in place in this mopped area before the bitumen cools.

(c) *Two Layer Application.* The second layer shall be laid in hot bitumen (minimum, 25 pounds per square) in the same manner as the first layer. The courses of the second layer shall be laid parallel to those of the first layer with all edges of each unit breaking joints with those of the first layer.

WATER CUT-OFFS

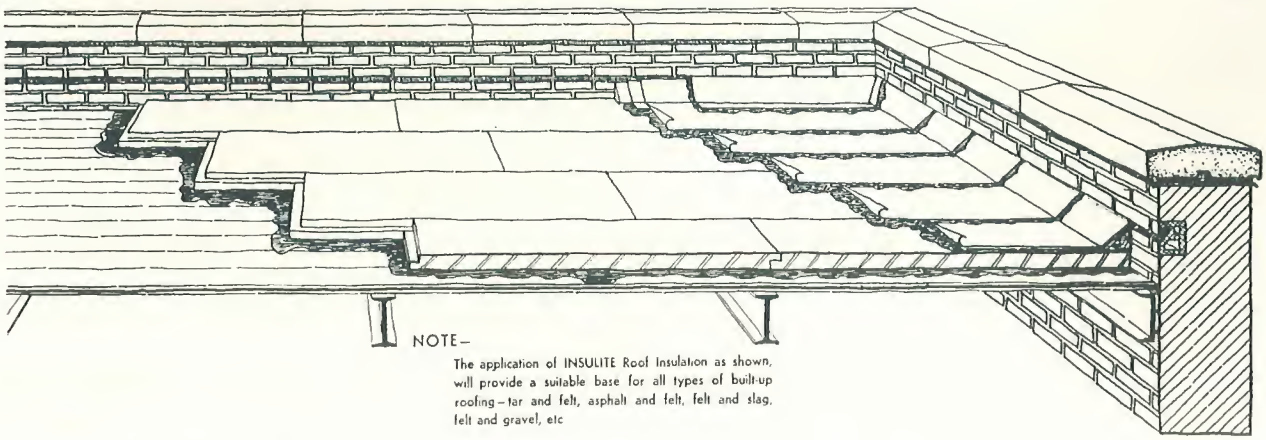
Water cut-offs consisting of 8- or 10-inch strips of felt saturated with the same bitumen as used for mopping shall be laid by mopping one edge of the strips to the roof in hot bitumen. Next fold the felt strip over the edge of the Insulite and mop to the top surface.

Water cut-offs shall be located about 22 inches from and parallel to all vertical walls and curbs, and around all leader heads, soil-pipes, vents, etc. The main body of the roof shall be marked off into rectangular areas from 25 to 30 feet on a side and each area isolated with a water cut-off. Each day's work shall be surrounded with a water cut-off even though it may terminate at a point other than a designated water cut-off.

All roof insulation laid each day shall be covered with at least one ply of roofing felt, mopped on in accordance with roofing specifications.

APPLICATION OF ROOFING

Roofing felt shall be embedded in hot bitumen over the Insulite in accordance with the manufacturers' specifications. (See "Guide to Good Practice," page 4.)



NOTE—
The application of INSULITE Roof Insulation as shown, will provide a suitable base for all types of built-up roofing—tar and felt, asphalt and felt, felt and slag, felt and gravel, etc

SPECIFICATIONS FOR APPLICATION OVER

Steel Decks—Under Built-up Roofing

PREPARATION OF DECK

Sweep deck clear of rubbish and see that it is dry. The steel decking shall be securely anchored to the roof purlins and all joints made rigid.

If the steel decking is not primed when manufactured, a coat of asphalt primer should be applied.

Where extremely humid conditions are to be expected, it is recommended that a layer of asphalt saturated asbestos felt be cemented directly to the steel deck under the insulation.

APPLICATION OF INSULATION

(a) *General.* Lay only as much Insulite each day as can be covered by the finished roofing that day. Abutting edges shall be brought to moderate contact and end joints in each course shall be staggered with those of adjoining courses.

Where cutting is necessary, the units shall be cut in a neat, workmanlike manner, so as to fit properly without forcing in place.

(b) *Applying the Insulite.* Mop the deck with hot asphalt (minimum, 25 pounds per square). (Do not use coal tar pitch on steel decks.) Mop only sufficient area at one time in which an Insulite unit can be laid while the asphalt is still soft.

(c) *Two Layer Application.* The second layer shall be laid in hot asphalt (at least 25 pounds per square), in the same manner as the first layer. The courses of the second layer shall be laid parallel to those of the first layer with all edges of each unit breaking joints with those of the first layer. (See photo, page 14.)

WATER CUT-OFFS

Water cut-offs consisting of 8- or 10-inch strips of asphalt-saturated felt or water-proof fabric shall be laid by mopping one-half of the strip to the roof in hot asphalt. Fold the remainder of the strip over the edge of the Insulite and mop to the top surface.

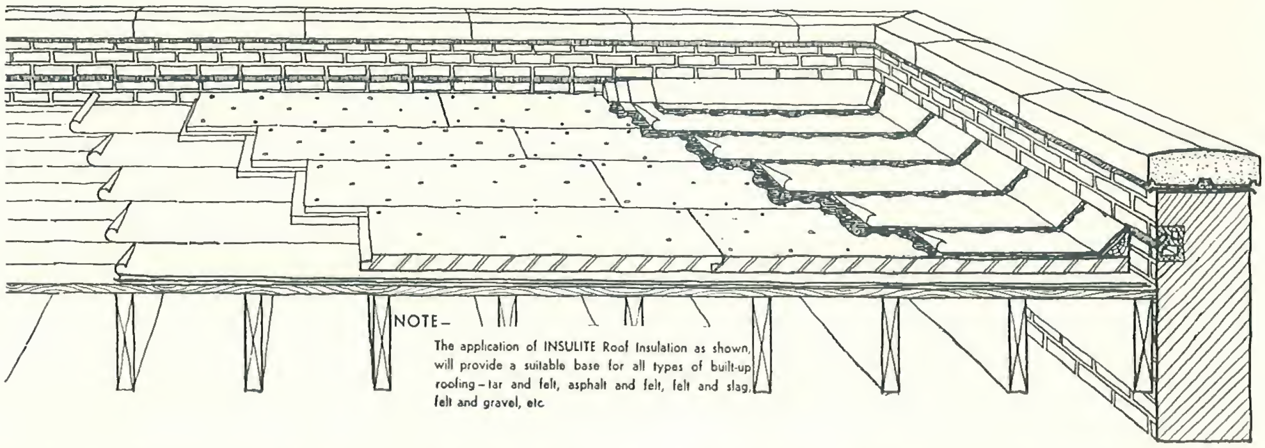
They shall be located about 22 inches from and parallel to all vertical walls and curbs, and around all leader heads, soil-pipes, vents, etc. The main body of the roof shall be marked off into rectangular areas from 25 to 30 feet on a side and each area isolated with a water cut-off. Each day's work shall be surrounded with a water cut-off even though it may terminate at a point other than a designated water cut-off.

All roof insulation laid each day shall be covered with at least one ply of the roofing felt, mopped on, in accordance with roofing specifications.

APPLICATION OF ROOFING

Roofing felt shall be embedded in hot asphalt over the Insulite in accordance with the manufacturers' specifications and in the desired number of plies. (See "Guide to Good Practice," page 4.)

For Heat Loss through roofs—
see chart, pages 11 and 12
For Fuel and Radiation Requirements—
see pages 15 and 16
For Prevention of Condensation—
see pages 19 and 20



SPECIFICATIONS FOR APPLICATION OVER

Wood Decks—Under Built-up Roofing Where High Humidity Is Not A Factor

ROOF DECK

The surface of the deck shall be broomed clean, free from dirt and thoroughly dry. All loose or springy boards shall be properly nailed before the insulation is laid.

SEAL COURSE

A seal course is especially recommended over wood decks without a separate ceiling underneath, in order to prevent the bitumen from dripping through cracks in the wood deck. The seal course shall consist of two plies of rosin-sized building paper or 6-pound coated felt, lapping the paper half its width over the preceding layer. Nail sufficiently to hold in place until the insulation is laid. (Also refer to Seal Courses under "A Guide to Good Practice," page 4.)

APPLICATION OF INSULATION

(a) *General.* Lay only as much insulation in one day as can be covered by the finished roofing that day. The abutting edges of the insulation units shall be brought to a moderate contact and not forced into place. Where necessary, cut units in a neat, workmanlike manner to fit properly, without forcing. The units shall be laid in parallel courses with end joints staggered with those of adjoining courses.

(b) *Nailing.* Each unit shall be secured in place by nails, 12″ apart, along each edge and staggered along the longitudinal center line of each unit.

The nails shall be long enough to pass through the insulation and penetrate the wood roof deck at least ¾″. Use galvanized roofing nails for thicknesses up to and including 1″. For greater thicknesses, use galvanized box nails of proper length.

(c) *Two Layer Insulation.* Shall be laid with the units of the second layer parallel to those of the first, and all joints shall be staggered with the joints of the first layer. It is necessary to nail the second layer only, merely tacking the 1st layer in place until the second is laid and then using a nail long enough to pass through both layers and penetrate the wood deck at least ¾″.

WATER CUT-OFFS

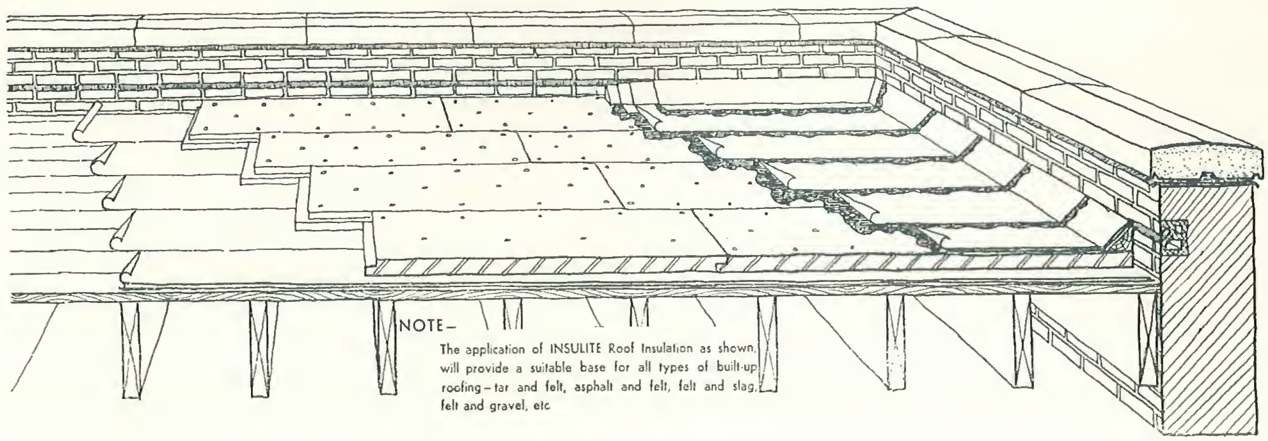
Water cut-offs shall be located approximately 22″ from and parallel to all vertical walls, such as parapets, penthouses, curbs, etc., and around all leader heads, soil-pipes, vents, etc. The main area of the roof shall be divided into rectangular areas from 25 to 30 feet on a side, each area isolated with a water cut-off. Insert a water cut-off around each day's work if stopped at a line other than a designated water cut-off.

Water cut-offs shall consist of 8- or 10-inch strips of roofing felt saturated with the same type of bitumen as used for mopping the insulation. They are to be first laid in hot bitumen to the building paper and folded over the edge of the insulation, and then mopped to the top surface in hot bitumen.

All roof insulation laid each day shall be covered with at least one ply of roofing felt, mopped on in accordance with roofing specifications.

APPLICATION OF ROOFING

Roofing felt shall be embedded in hot bitumen in accordance with the manufacturers' specifications. (See "Guide to Good Practice," page 4.)



SPECIFICATIONS FOR APPLICATION OVER
Wood Decks—Under Built-up Roofing Where High Humidities are Maintained

PREPARATION OF DECK

Sweep the deck clear of all dirt and rubbish and see that the roof is thoroughly dry. All loose or springy boards shall be rigidly nailed in place.

MEMBRANE WATER-PROOFING COURSE

Over the wood deck lay one course of red rosin paper, then 2 plies (half lapped) of bitumen saturated paper (15 pounds per square), coated one side. Lay coated side down. Nail the exposed edge of each sheet with tin-capped roofing nails. All laps shall be mopped with hot bitumen back 12 inches from edge. Do not mop over this membrane until just prior to laying the Insulite.

APPLICATION OF INSULATION

(a) *General.* Lay only as much Insulite in a day as can be covered by the finished roofing in that day. Abutting edges of the units shall be brought to moderate contact. The units shall be laid in courses with end joints staggered with those of adjoining courses. Where cutting is necessary, the units shall be cut in a workmanlike manner so as to fit properly without forcing in place.

(b) *Mopping the Water-proof Membrane.* Mop the water-proof membrane with hot bitumen (minimum, 25 pounds per square), covering only sufficient area at one time in which to lay each unit of Insulite while the bitumen is still hot.

(c) *Two Layer Insulation.* The second layer shall be laid in the same manner as the first. The courses of the second layer shall be laid parallel to those of the first with all edges of each unit breaking joints with the joints of the first layer.

WATER CUT-OFFS

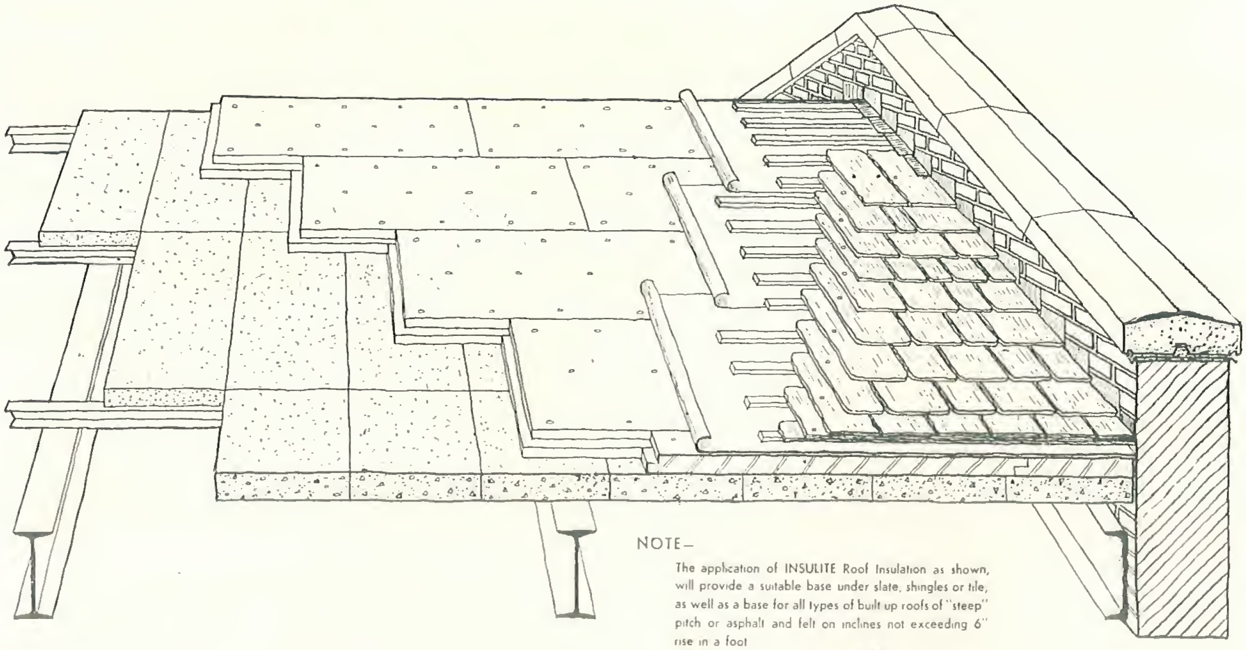
Water cut-offs consisting of 8- or 10-inch strips of bitumen-saturated felt or water-proof fabric shall be laid by mopping one-half of the strip to the roof in hot bitumen. Next fold the remainder of the strip over the edge of the Insulite and mop to the top surface.

They shall be located about 22 inches from and parallel to all vertical walls and curbs, and around all leader heads, soil-pipes, vents, etc. The main body of the roof shall be marked off into rectangular areas from 25 to 30 feet on a side and each area isolated with a water cut-off. Each day's work shall be surrounded with a water cut-off even though it may terminate at a point other than a designated water cut-off.

All roof insulation laid each day shall be covered with at least one ply of the roofing felt, mopped on, in accordance with roofing specifications.

APPLICATION OF ROOFING

Roofing felt shall be embedded in hot bitumen over the Insulite in accordance with the manufacturers' specifications (See "Guide to Good Practice," page 4.)



SPECIFICATIONS FOR APPLICATION OVER

Steep Roofs of Wood or Nailing Concrete

(Under Tile or Rigid Shingles)

PREPARATION OF ROOF

Sweep the roof clear of all rubbish. See that all joints are secured rigidly in place.

APPLICATION OF INSULATION

Each unit shall be nailed in place with nails of sufficient length to pass through the Insulite and penetrate at least ¾" into wood or 1" into nailing concrete. Space the nails about 12" O.C. along the edges and staggered on the horizontal center line of each unit.

WATER-PROOF MEMBRANE

Lay one ply of water-proof paper, coated at least one side with bitumen, over the Insulite, lapping each layer at least two inches and nailing in place with tin-capped, galvanized nails of sufficient length to pass through the insulation and penetrate the nailing base as specified above. Lay the paper with the coated surface up.

NAILING STRIPS

Over the paper lay continuous horizontal 1 x 2 furring strips, nailing them in place with nails 16" O.C. of sufficient length to pass through the Insulite and penetrate the nailing base at least ¾" in wood or 1" in nailing concrete. Space the strips so as to be accurately in position to receive the nails for each successive course of shingles or tiles. This spacing will correspond to the exposure of the shingles or tiles.

APPLICATION OF ROOF COVERING

Lay the shingles or tiles in the usual manner, according to manufacturers' specifications.

(a) *Flashing* shall be provided for as required wherever the roof intersects with vertical surfaces, such as parapets, chimneys, curbs, etc. Also provide saddles on the upper side of chimneys, soil-stacks, vents, etc., when they project through the roof at points other than the ridge. (See "Guide to Good Practice.")

ALTERNATE SPECIFICATIONS

These specifications are for use where circumstances or local conditions require a method of application other than outlined by the Standard Specifications given on the preceding pages.

SPOT MOPPING

"Spot" or "strip" mopping is required when mopping Insulite Roof Insulation to steel decks or unit tile decks where there is a possibility of the bitumen dripping through joints between the individual units. On other types of roof decks "spot" mopping shall be permitted only upon approval of the architect and roofing manufacturer.

Under no circumstances shall "spot" or "strip" mopping be permitted where high prevailing winds are common or where prevailing winds are from a direction such that a strong suction would be developed over the roof with a resultant tendency to lift the roofing from the Insulite or the Insulite from the deck.

LAYING THE INSULITE ROOF INSULATION

When laying the first layer of Insulite, "spot" mop the deck with three spots per unit placed so that the spots occur along the longitudinal center line of the unit. Each spot is to be approximately 8″ or 10″ in diameter. Lay the Insulite units in the bitumen while still hot.

The second layer, if any, is to be laid in the same manner, breaking all joints with those of the first layer. The courses of the second layer shall be laid parallel to the courses of the first layer.

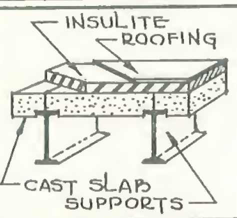
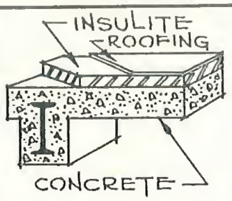
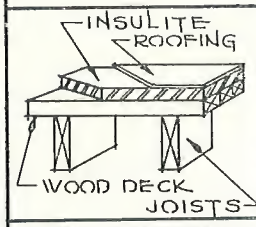
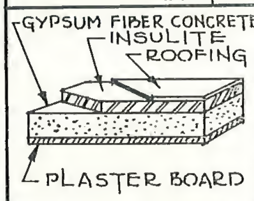
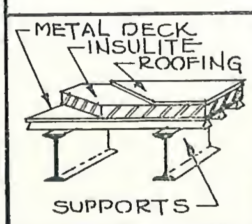
APPLYING THE ROOFING

Spot mopping of the built-up roofing over the Insulite shall be in accordance with the roofing manufacturers' specifications.

Where eaves and edges are exposed (no parapets or fire walls) the roofing felts shall be solid mopped to the insulation for a distance of not less than three (3) feet back from exposed edges at such places and protected and firmly anchored with metal edging or gravel guards.

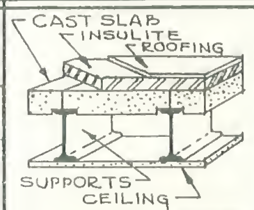
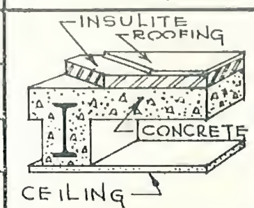
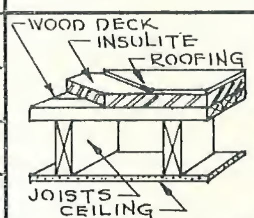
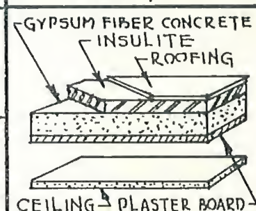
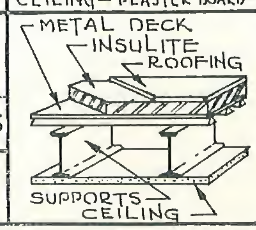
Greyhound Bus Depot at New York City

COEFFICIENTS OF HEAT TRAN
RESISTANCES (R) OF VARIOUS TYPE
BUILT-UP F

CONSTRUCTION TYPE WITHOUT CEILINGS	TYPE OF ROOF DECK	THICKNESS OF ROOF DECK (in inches)		NO Insulation	½" INSULITE Roof Insulation	1" INSULITE Roof Insulation	1½" INSULITE Roof Insulation	2" INSULITE Roof Insulation
	PRECAST CEMENT TILE	1⅝	U	0.84	0.37	0.24	0.18	0.14
			R	**1.19**	**2.70**	**4.17**	**5.56**	**7.15**
	CONCRETE	2	U	0.82	0.37	0.24	0.17	0.14
			R	**1.22**	**2.70**	**4.17**	**5.89**	**7.15**
	CONCRETE	4	U	0.72	0.34	0.23	*0.17	*0.13
			R	**1.39**	**2.94**	**4.35**	**5.89** 16	**7.70**
	CONCRETE	6	U	0.64	0.33	0.22	0.16	0.13
			R	**1.56**	**3.03**	**4.55**	**6.25**	**7.70**
	WOOD	1	U	0.49	0.28	0.20	0.15	0.12
			R	**2.04**	**3.58**	**5.00**	**6.67**	**8.34**
	WOOD	1½	U	0.37	0.24	0.18	0.14	0.11
			R	**2.70**	**4.17**	**5.56**	**7.15**	**9.10**
	WOOD	2	U	0.32	0.22	0.16	0.13	0.11
			R	**3.13**	**4.55**	**6.25**	**7.70**	**9.10**
	WOOD	4	U	0.23	0.17	0.14	0.11	0.096
			R	**4.35**	**5.89**	**7.15**	**9.10**	**10.42**
	2" GYPSUM FIBER CONCRETE ON ⅜" PLASTER BOARD	2⅜	U	0.40	0.25	0.18	0.14	0.12
			R	**2.50**	**4.00**	**5.56**	**7.15**	**8.34**
	3" GYPSUM FIBER CONCRETE ON ⅜" PLASTER BOARD	3⅜	U	0.32	0.22	0.16	0.13	0.11
			R	**3.13**	**4.55**	**6.25**	**7.70**	**9.10**
	FLAT METAL ROOFS		U	0.95	0.39	0.25	0.18	0.14
			R	**1.05**	**2.57**	**4.00**	**5.56**	**7.15**

1½" ✓ "
* 1½" cork
* 2" "

NSMISSION (U) AND THERMAL ES OF FLAT ROOFS COVERED WITH ROOFING

2" INSULITE Roof Insulation	1½" INSULITE Roof Insulation	1" INSULITE Roof Insulation	½" INSULITE Roof Insulation	NO Insulation		THICKNESS OF ROOF DECK (in inches)	TYPE OF ROOF DECK	CONSTRUCTION TYPE WITH CEILINGS
0.12 **8.35**	0.15 **6.68**	0.19 **5.27**	0.26 **3.85**	0.43 **2.33**	U **R**	1⅝	PRECAST CEMENT TILE	
0.12 **8.35**	0.15 **6.68**	0.19 **5.27**	0.26 **3.85**	0.42 **2.38**	U **R**	2	CONCRETE	
0.12 **8.35**	0.14 **7.15**	0.18 **5.56**	0.25 **4.00**	0.40 **2.50**	U **R**	4	CONCRETE	
0.11 **9.10**	0.14 **7.15**	0.18 **5.56**	0.24 **4.17**	0.37 **2.70**	U **R**	6	CONCRETE	
0.11 **9.10**	0.13 **7.70**	0.16 **6.25**	0.21 **4.77**	0.32 **3.12**	U **R**	1	WOOD	
0.10 **10.00**	0.12 **8.35**	0.15 **6.68**	0.19 **5.27**	0.26 **3.85**	U **R**	1½	WOOD	
0.097 **10.30**	0.11 **9.10**	0.14 **7.15**	0.17 **5.89**	0.24 **4.17**	U **R**	2	WOOD	
0.087 **11.50**	0.10 **10.00**	0.12 **8.35**	0.14 **7.15**	0.18 **5.56**	U **R**	4	WOOD	
0.10 **10.00**	0.12 **8.35**	0.15 **6.68**	0.19 **5.27**	0.27 **3.70**	U **R**	2⅜	2" GYPSUM FIBER CONCRETE ON ⅜" PLASTER BOARD	
0.097 **10.30**	0.11 **9.10**	0.14 **7.15**	0.17 **5.89**	0.23 **4.35**	U **R**	3⅜	3" GYPSUM FIBER CONCRETE ON ⅜" PLASTER BOARD	
0.12 **8.35**	0.15 **6.68**	0.19 **5.27**	0.27 **3.70**	0.46 **2.18**	U **R**		FLAT METAL ROOFS	

K .16
.12

FUEL SAVINGS ANALYSIS

of a typical industrial roof

By the way of explanation of the table of "Heat Transmission and Thermal Resistance for Various Flat Roofs" as given on pages 11 and 12, there is outlined below an example of fuel savings, made possible by insulating a typical building with the following assumed conditions.

TYPICAL INDUSTRIAL ROOF

ROOF CONSTRUCTION—6″ concrete deck including roofing (similar to 2nd illustration from top of page 11).

AREA (square feet)	30,000
HEATING PLANT EFFICIENCY	65%
CALORIFIC VALUE OF COAL USED FOR FUEL (b.t.u. per lb.)	12,500
INSIDE TEMPERATURE	70° F.
DESIGN TEMPERATURE*	—20° F.
SEASON HEATING LOAD (degree days)	8,000
CONDUCTIVITY OF UNINSULATED ROOF (U)	0.64
CONDUCTIVITY OF ROOF INSULATED WITH 1″ INSULITE (U)	0.22

FUEL SAVING

Coal consumed by passage of heat through uninsulated roof:

$$\frac{.64\ (\text{b.t.u./hr.}) \times 30{,}000\ (\text{sq.ft.}) \times 24\ (\text{hrs./day}) \times 8{,}000\ (\text{deg. days})}{12{,}500\ (\text{b.t.u./lb.}) \times 65\%\ (\text{Htg. Plant Eff.}) \times 2{,}000\ (\text{lb./ton})} = 227.5\ \text{Tons}$$

Coal consumed by passage of heat through insulated roof:

$$\frac{.22 \times 30{,}000 \times 24 \times 8{,}000}{12{,}500 \times .65 \times 2{,}000} = 78\ \text{Tons}$$

ANNUAL COAL SAVING WITH INSULITE..149.5 Tons

RADIATION SAVING

Radiation required for uninsulated roof:

.64 (b.t.u./hr.) × 30,000 (sq. ft.) × 90 (° F. temp. diff. [70 — (—20)])
= 1,728,000 b.t.u. = 1,728 Mb. (thousand b.t.u.)

Radiation required for insulated roof:

.22 × 30,000 × 90° = 594,000 b.t.u. = 594 Mb.

ORIGINAL SAVING IN RADIATION WITH INSULITE ....1,134 Mb.

**Design temperature is the low outside temperature used in the design of a heating system. It is assumed to be not more than 15° F. above the lowest temperature recorded by the Weather Bureau for any locality during the previous ten years.*

SAVING IN MONEY

149.5 Tons of Coal @	$...........			$.............
1,134 Mb. of Radiation @	$...........	(installed)	$.............	$.............
		TOTAL SAVING		$.............
Additional Cost of Insulation:				
Cost of 1″ Insulite (applied)	$...........			
Interest on Investment @ 6%	$...........			
Depreciation @ 4%	$...........			$.............
		NET SAVING FIRST YEAR		$.............

Prices vary so greatly in different localities that we will not attempt to quote prices on the various items shown under "Saving in Money," but have left blanks in which these can be entered for your locality and thus you can determine the actual saving. The result will be found to show that the cost of the application of Insulite will be paid for by the saving effected in fuel and installed radiation in the very first year and the fuel saving will continue to provide dividends each year thereafter.

The uninsulated roof will permit a relative humidity of but 25% whereas the insulated roof will permit a relative humidity of 66% with a heat head of 90° before condensation will occur on the ceiling with an outside temperature of 20° below zero.

Insulite Applied to Pitched Roof

Insulite Applied Over Steel Deck

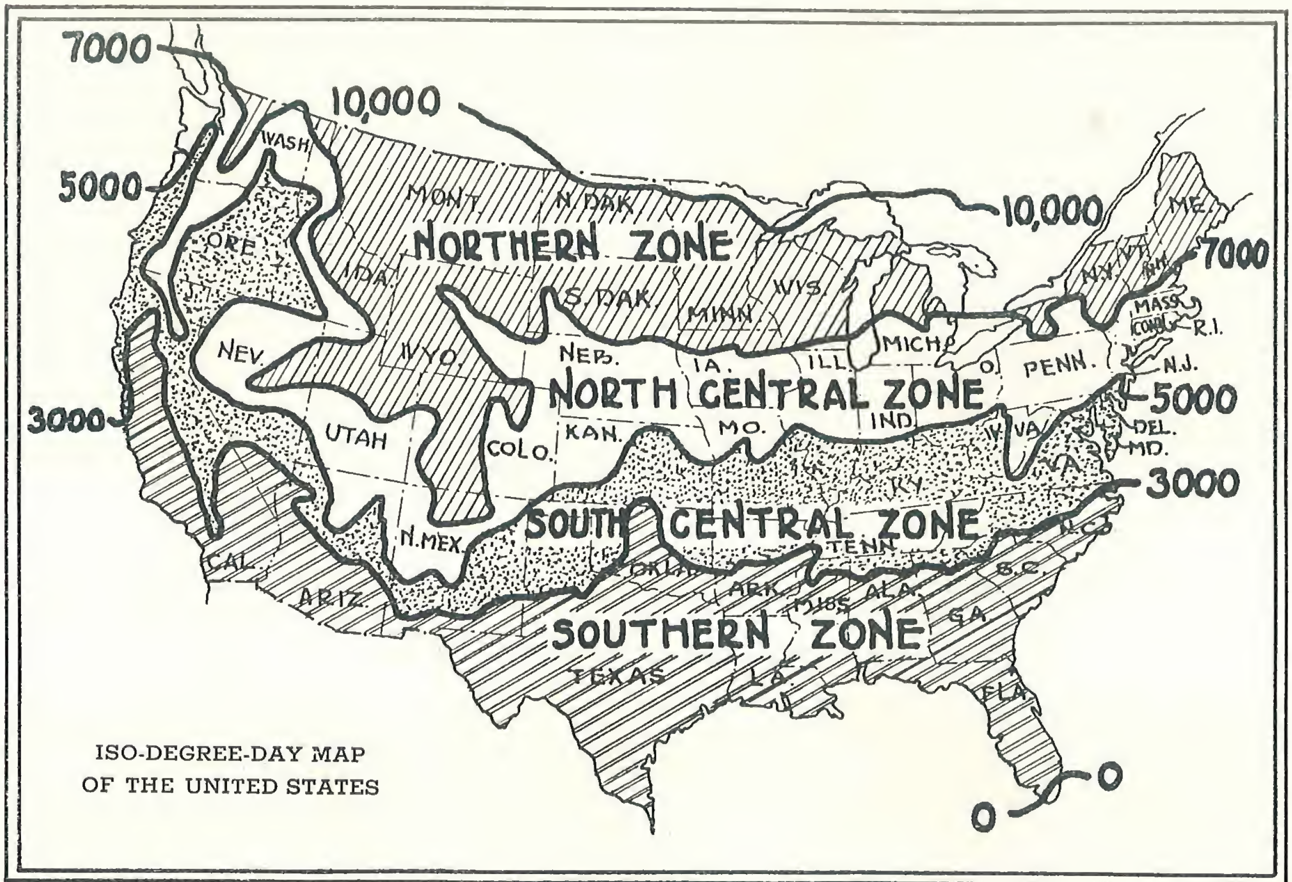
EXPLANATION OF FUEL AND RADIATION REQUIREMENTS CHART

Each diagonal line of the chart on page 16 graphically represents a formula for both fuel and radiation requirements. The figures at the right on each curve indicate the degree days, and are the ones to refer to when calculating fuel requirements. The bracketed figures indicate the Design temperature in degrees Fahrenheit and are the ones to use in calculating radiation requirements.

To use the chart, start from the horizontal bottom line, at a point corresponding to the conductivity value (U) for the roof selected from the tables on pages 11 and 12. Proceed vertically from this point to the diagonal line representing the average season heating load in degree days which prevails in the locality in which the building is to be erected and which can be determined from the degree day map on the bottom of this page. From here read horizontally to the extreme right of the chart where the value of "A" may be read. This is the value to substitute in the equations shown in the lower left hand corner of the chart, and is to be multiplied by the number of thousands of square feet area of the roof in question, to determine the amount of fuel for the heat lost through this roof.

Using the insulated roof taken for our example on pages 13 and 14, start at .22, on the bottom line reading up to the diagonal line of 8,000 degree days and then across to the right, the value of "A" is found to be 2.59 and for coal this is to be multiplied by 1.—the equation is $2.59 \times 1 \times 30 = 77.7$ tons. For oil the equation would be $2.59 \times 153.66 \times 30 = 11,950$ gallons.

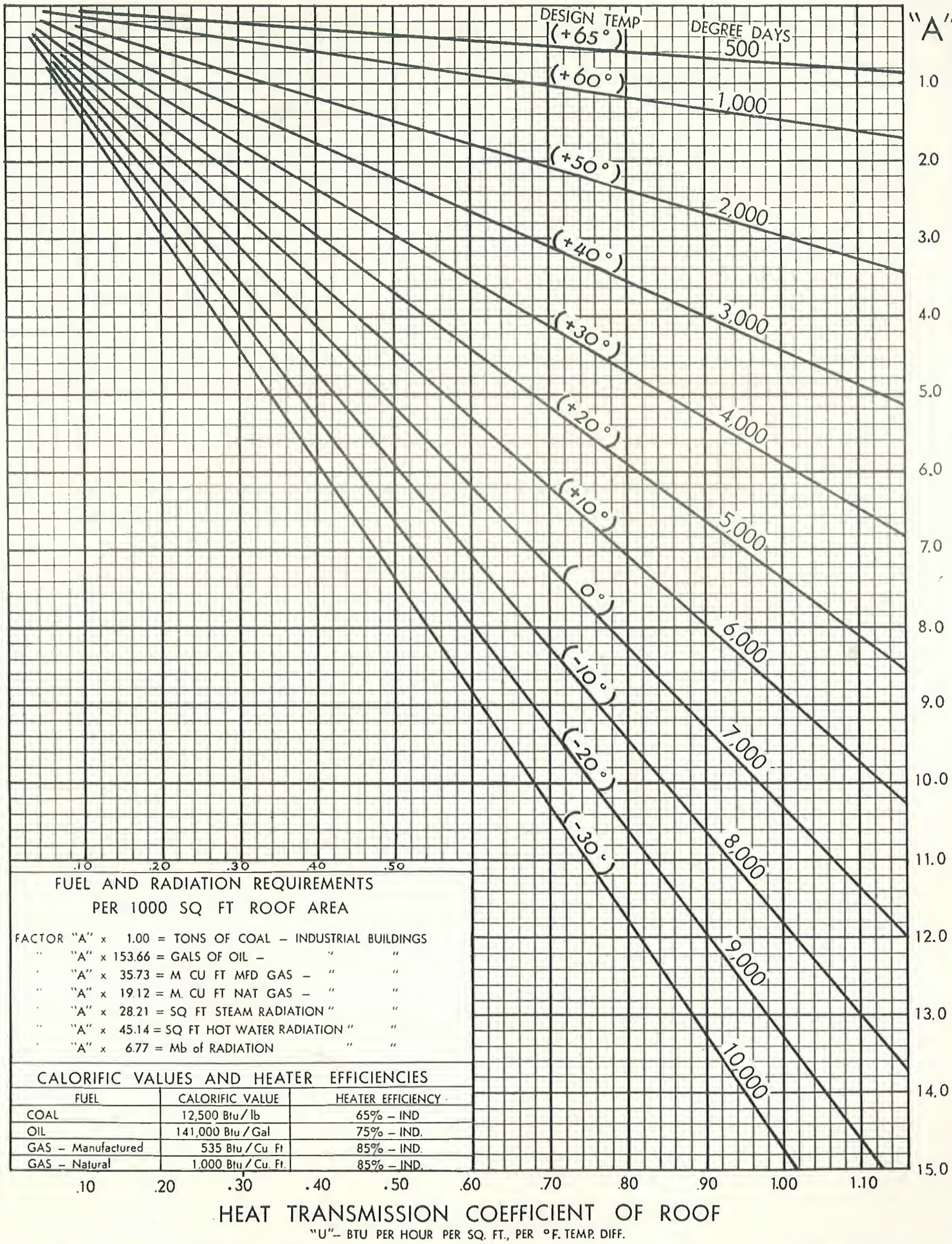
For radiation requirements proceed the same way but refer to the diagonal line marked with the proper Design temperature. These lines are based on 70° indoor air temperature. In the problem on pages 13 and 14 the Design temperature was —20°. Read "A" as 2.93. Multiply this by 6.77 and the number of thousand square feet in the roof. The equation then becomes: $2.93 \times 6.77 \times 30 = 594$ Mb. (thousand b.t.u.). In case the room temperature were to be 80° F. instead of 70°, the Design temperature line marked —30° should be used or for a room temperature of 60° use —10°.



ISO-DEGREE-DAY MAP
OF THE UNITED STATES

FUEL AND RADIATION REQUIREMENTS CHART

(PER 1000 SQ. FEET OF AREA)



FUEL AND RADIATION REQUIREMENTS
PER 1000 SQ FT ROOF AREA

FACTOR "A" x 1.00 = TONS OF COAL – INDUSTRIAL BUILDINGS
" "A" x 153.66 = GALS OF OIL – " "
" "A" x 35.73 = M CU FT MFD GAS – " "
" "A" x 19.12 = M. CU FT NAT GAS – " "
" "A" x 28.21 = SQ FT STEAM RADIATION " "
" "A" x 45.14 = SQ FT HOT WATER RADIATION " "
" "A" x 6.77 = Mb of RADIATION " "

CALORIFIC VALUES AND HEATER EFFICIENCIES

FUEL	CALORIFIC VALUE	HEATER EFFICIENCY
COAL	12,500 Btu / lb	65% – IND
OIL	141,000 Btu / Gal	75% – IND.
GAS – Manufactured	535 Btu / Cu Ft	85% – IND.
GAS – Natural	1,000 Btu / Cu. Ft.	85% – IND.

THE PREVENTION OF CONDENSATION

Condensation of moisture on walls and ceilings is a factor which must be taken into consideration in building structures of various types, particularly those housing industries for which high humidities are essential to their proper operation. Just as moisture collects on the outside of a tumbler of cold water on a hot day, so will it also form on the under side of a roof deck or ceiling if the roof is not insulated sufficiently to prevent the temperature of the under surface from becoming too cold.

It is a scientific fact that when air of a given temperature and humidity comes in contact with a surface, the temperature of which is below the dew point of such air, the excess moisture from the air will condense and collect on the cold surface.

HUMIDITY AND CONDENSATION

The temperature at which air becomes saturated (100% Relative Humidity) is known as the "Dew Point," (D.P.). The difference in temperature between the room or air temperature (t_r), and the temperature of the ceiling or wall surface (t_s) is called the temperature drop, (t.d.) (t.d. $= t_r - t_s$). The maximum temperature drop that can be permitted before condensation will form on a surface is the difference between air temperature and D.P. (t_r — D.P. = allowable t.d.).

The allowable t.d. will differ greatly for various conditions of temperature and R.H. For example, take two conditions, both having the same room temperature but different R.H. as "A" and "B":

"A" $t_r = 80°$ F. R.H. = 85%
D.P. = 74.8° F. allowable t.d. = 5.2° F.
"B" $t_r = 80°$ F. R.H. = 50%
D.P. = 59.8° F. allowable t.d. = 20.2° F.

Insulite Roof Insulation Laid Out With Water Cut-Offs

From the above, it will be seen that it will be necessary to keep the temperature of the under surface of the roof deck or ceiling at a temperature above 74.8° F. in order to maintain temperature and R.H. conditions of "A" and still not have condensation on that surface. On the other hand, if the air conditions of "B" are all that are necessary for successful operation of the plant, then the ceiling surface need only be kept from falling as low as 59.8° F., or an allowable t.d. of 20.2°.

Condensation collects in sweat-like beads on the roof or ceiling and from there drips down onto materials and machinery, causing severe damage and heavy financial loss. It also creeps down the walls, causing plaster disintegration and discoloration of the painted walls. Furthermore, the constant collection of moisture on the roof causes wood to rot and steel to rust. All these add immensely to the building's upkeep and depreciation costs.

INSULITE PREVENTS CONDENSATION

This condition, with its resultant damage and loss can be avoided with the use of the proper amount of insulation in the roof construction. Insulation retards the passage of indoor heat out through the roof. Consequently, the more insulation used, the higher will be the temperature of the inside surface with a resulting lower temperature drop from the indoor air temperature to the inside surface temperature.

Insulite Roof Insulation, due to its high insulating value, durability and resistance to moisture, has proven its value for many years, in hundreds of buildings of various types. These include textile mills, printing plants, tobacco warehouses, laundries, bakeries, dry kilns, paper mills, power plants, and many other industrial, commercial and public buildings.

In the last decade, vast improvements have been made in equipment for creating and controlling humidity. Hand in hand with the production of such equipment, extensive research has been carried on by many agencies, to determine how much humidity is essential to the successful operation of each industry. As a result there are very few industrial buildings at present that do not operate some form of indoor weather-making equipment. In some industries, such as the textile mills, especially in certain rooms or sheds, it is essential to maintain as high a humidity as possible.

OTHER ADVANTAGES OF INSULITE

Insulite used in such buildings not only lowers the operating cost of the humidifying equipment

but also solves the problem of condensation and consequent detrimental results, as pointed out in preceding paragraphs.

Another condensation problem is the prevention of frost on walls and ceilings of farm buildings. When the inside surface temperature is below 32° F. the condensation, as above described, freezes, and is visible as frost. In poultry and hog buildings and especially in horse and cattle barns, the air is laden with moisture exuded by the animals. In the winter, uninsulated walls will be cold and frost forms there, creating generally unhealthful and unsanitary conditions in addition to the damage done to the structure because of the moisture. Insulite in such buildings permits proper ventilation and prevents the accumulation of frost.

In buildings already erected, condensation can be avoided by applying Insulite to the ceilings. Details for the application of Insulite for such conditions will be furnished upon request to the Insulite Company, Minneapolis, Minnesota.

On the next page you will find an explanation of the chart on page 20 by means of which it is possible to determine the proper amount of Insulite to use for a predetermined condition of temperature and humidity in order to be free from condensation problems.

Applying Graylite Roof Insulation

Insulite Graylite Roof Insulation On Minneapolis Armory

HOW TO USE THE CONDENSATION CHART

Whether or not condensation will collect on a ceiling depends upon four variable factors: room temperature, outside temperature, percentage of relative humidity in the room air and the conductivity of the roof. There are two ways of approaching this problem, depending upon which of these factors are known. In the case of an industry for which the relative humidity requirements are not extremely high and in which no construction changes in their existing building are contemplated, the problem may be that of determining how much humidity can be used in the air without danger of condensation when the room temperature, low outside temperature and roof conductivity are the known factors. This can be determined from the Condensation Chart on the opposite page.

More often, however, the problem will be to determine the conductivity of the roof which will prevent condensation when the room temperature, the Design Temperature, and the desired relative humidity are the known factors. For this reason, we will explain the use of the chart in solving this type of problem.

HOW TO DETERMINE THE ROOF COEFFICIENT WHICH WILL STOP CONDENSATION

Heat Head (HH) is the difference in Degrees F between the room temperature (t_r) and Design Temperature. HH = t_r — Design Temperature (represented by the curves in the upper portion of the chart).

Relative Humidity in percentages are represented by the diagonal lines in the lower portion of the chart.

Room Temperatures are represented by the horizontal lines in the lower part of the chart.

Roof Coefficients necessary in the roof construction to prevent condensation under various conditions are represented by the horizontal lines in the upper part of the chart. These may be read in terms of Overall Conductivity (U) by referring to the proper line of figures at the extreme left, or in terms of Resistance (R) by referring to the line of figures under "R."

Starting at the lower left hand edge of the chart, select the room temperature to be used and follow the horizontal line to the right until it intersects the diagonal line representing the required percentage of Relative Humidity. Directly beneath this intersection at the bottom of the chart read the temperature drop which will cause condensation. Now, from this same intersection follow up the vertical line until it intersects the curve representing the Heat Head which will apply to your problem. From this intersection follow the horizontal line to the extreme left hand side of the chart where the required roof coefficient may now be determined, by referring to the column of figures under "R" if Resistance is wanted or under "U" if conductivity is the value to be used.

From the chart on pages 11 and 12 determine the amount of Insulite to be used to provide the required roof coefficient for the type of roof construction involved in your problem.

EXAMPLE—(Illustrated in small insert)

Room Temperature = 70°.
Outside Temperature = 20° below zero.
Heat Head 70 — (—20) = 90°.
R. H. (Inside) = 65%.
Construction of Roof = 6″ concrete slab.
Required—Amount of Insulite to stop condensation.

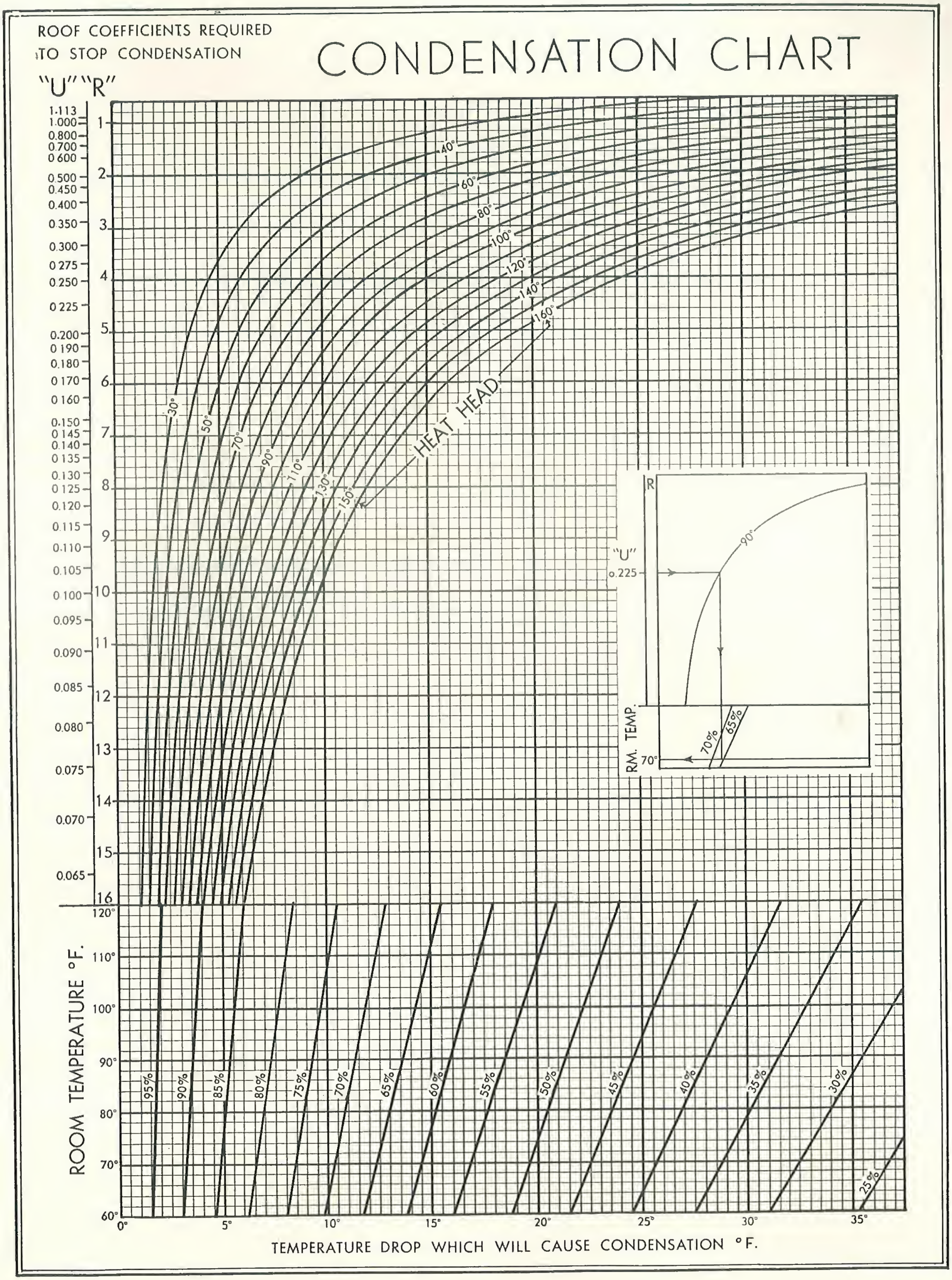
Start at room temperature of 70° and follow the horizontal line until it intersects the 65% humidity line. Follow the vertical line at this intersection up until it intersects the Heat Head curve of 90°. From this intersection follow the horizontal line to the left of the chart and read from the extreme left column of figures the (U) coefficient of 0.228 b.t.u. /sq. ft./hr./° F.

From the chart on page 11 it will be seen that 1″ of Insulite Roof Insulation will provide a coefficient "U" of 0.22 for a 6″ concrete slab deck without ceilings. This is slightly better than required and therefore 1″ of Insulite will permit slightly more than 65% R.H. before condensation will start to collect on the ceiling.

THE CHARTS ARE EASY TO USE

The Condensation Chart as well as the Fuel and Radiation Requirements Chart take the place of considerable mathematical computation which would be necessary were they not available. With a little experience using them, it becomes a very simple matter to determine the amount of insulation required for any type of roof or wall to prevent condensation under known or assumed temperature and humidity conditions, or to determine the amount of fuel and radiation required to compensate the heat losses through roofs or walls containing various amounts of insulation.

CONDENSATION CHART



SOME REPRESENTATIVE BUILDINGS INSULATED WITH INSULITE ROOF INSULATION

These are but a few of the many buildings on which Insulite Roof Insulation has been used. This list includes a wide variety of types of buildings, scattered throughout the entire nation. There are many other buildings in all parts of the world likewise being protected from the elements by Insulite in one way or another.

Post Office Building	Baltimore, Maryland
Goodyear Zeppelin Hangar	Akron, Ohio
General Motors Company Dry Kiln	Pontiac, Michigan
Park School	Hibbing, Minnesota
Greyhound Bus Lines Service Garage	Washington, D. C.
Greyhound Bus Lines Depot	New York City
Minneapolis Honeywell Co. Warehouse	Minneapolis, Minn.
Lincoln High School	Kansas City, Mo.
Haines Studio Apartments	Rapid City, S. D.
Baptist Church	Tyler, Texas
Limoneria Lemon Packing Plant	Santa Paula, Cal.
Akron Pure Milk Co.	Akron, Ohio
Minneapolis National Guard Armory	Minneapolis, Minn.
U. S. Treasury Building	Washington, D. C.
Philadelphia College of Pharmacy and Service	Philadelphia, Pa.
Indianapolis Light and Heat Company	Indianapolis, Ind.
Oak Park Post Office	Oak Park, Illinois
Purity Baking Corp. Bakery	Duluth, Minnesota
University of Minnesota Sports Building	Minneapolis, Minn.
Kronick Laundry	Minneapolis, Minn.
Ford Factory	Tokio, Japan
Municipal Slaughter House	Helsingfors, Finland
Commonwealth Edison Power Plant	Chicago, Illinois
Eastern States Farmers Exchange Bank	West Springfield, Mass.
Roberts Park Church	Indianapolis, Ind.
Minnetonka Dairy Company	Minneapolis, Minn.
Chicago, Rock Island & Pacific Railroad Depot	Chicago, Illinois
Chicago, Milwaukee, St. Paul & Pacific R. R. Depot	Braymer, Missouri
Family Service Laundry Company	Peoria, Illinois
Marmon Motor Company	Indianapolis, Ind.
Bethlehem Steel Company	Baltimore, Maryland
Driver Harris Company	Harrison, N. J.
National Licorice Company	Philadelphia, Pa.
Geo. Washington School	Long Beach, California
Manual Arts School	Hastings, Nebraska
Brown Hotel	Des Moines, Iowa
Lincoln Traction Company	Lincoln, Nebraska
McKelvey Department Store	Youngstown, Ohio
Fenway Baseball Park	Boston, Massachusetts
Post Office	Beverly Hills, Cal.
Hartmann Building	Chicago, Illinois
Dept. of Interior, Federal Office Building	Washington, D. C.
U. S. Treasury Office, Money Vault	Washington, D. C.
Orange Coach Line	Manitowoc, Wis.
Old Quaker Distillery	Laurenceburg, Ind.
Niagara Food Terminal	Buffalo, New York
Pacific Telephone and Telegraph Co.	San Francisco, Cal.
Theatre (Times Square)	New York City

INSULITE ROOF INSULATION PRODUCTS

INS-LIGHT ROOF INSULATION

GRAYLITE ROOF INSULATION

OTHER INSULITE PRODUCTS

INS-LIGHT BUILDING BOARD

GRAYLITE BUILDING BOARD

BILDRITE SHEATHING

LOK-JOINT LATH

INS-LIGHT TILE AND PLANK

GRAYLITE TILE AND PLANK

INS-LIGHT COLD STORAGE INSULATION

SEALSLAB COLD STORAGE INSULATION

INSULITE HARDBOARD PRODUCTS

For Information on Any of Your Insulation Problems or Regarding Above Products

WRITE

THE INSULITE COMPANY
1100 BUILDERS EXCHANGE
MINNEAPOLIS, MINNESOTA

PRINTED IN U.S.A.

PENRHYN STONE

SLATE ROOFS OF QUALITY

Office of SPEER REALTY CO., Englewood, N. J.—*Geo. A. Licht, Architect*

DESCRIPTIVE CLASSIFICATION

Specifications for Graduated Architectural Roofs

PENNA. OFFICE
DRAKE BUILDING
EASTON, PA.

J. W. Williams Slate Company
Architectural Service Department: 103 Park Ave. New York
EASTON, PA.

VERMONT OFFICE
POULTNEY
VERMONT

A. I. A. File No. 12 d

PENRHYN STONE

THE quarries containing this slate rock lie mainly in the Penrhyn Hills on the border line of the states of Vermont and New York and were originally opened over fifty years ago when the demand was entirely for slate of commercial thickness and smooth surface. Blocks of slate that would not split thin enough and smooth enough to comply with the requirements were discarded and finally the quarries were closed down about twenty years ago.

In the meantime American Architects had developed an entirely changed conception of a slate roof--a transition from the strictly commercial type to a highly textureful requirement of modified color tones that would blend harmoniously with the material used in construction. The abandoned quarries and discarded blocks of slate which through exposure to the elements had developed wonderful colorings proved when worked over by experienced craftsmen to have the rough surface texture so necessary to the desired Architectural effect.

Penrhyn Stone is produced by skilled craftsmen — quarried, split and trimmed entirely by hand into such sizes and thicknesses that each individual roof requires as determined by a study of the Architect's plans.

Penrhyn Stone is essentially an Architect's Slate and especially adaptable to roofs where texture, color, general excellence and integrity of the material itself in addition to the Architectural effectiveness, is the paramount object.

In the offering of Penrhyn Stone the Architectural Profession is assured that the quality, blend of colors and general Architectural excellence is unequalled by any other slate deposits in America. A roof of "Penrhyn Stone" has the immediate effect of a roof that has been laid for a great number of years--mellowness of color and beauty of texture.

ROOF DESIGN AND SERVICE

Our Architectural Department in New York will be pleased to prepare estimates and make suggestions based on any plans submitted—this service is without charge and all plans will be promptly returned.

On work of an important character we personally superintend the application of the slate and accept the responsibility attached to its completion in accordance with the intent and to the satisfaction of the Architect.

Residence of ALFRED G. SMITH, Greenwich, Conn. — *William F. Dominick, Architect*

Residence of OSCAR HAMMERSTEIN, Great Neck, L. I. — *Hunt & Kline, Architects*

Roof Architecture -
The English Cottage

THE growing popularity of the English type of Architecture for residential projects with its diversified effects in which the roof plays a highly important and conspicious part has created an entirely new demand in roof service.

The use of slate as the roof covering is practically universal in England and no other roofing material possesses the natural surface texture and variation in color and thickness so necessary to create harmony between the roof and the structure itself and give the true Architectural effect.

An English cottage in perspective is usually more than one-half roof and in order to be an Architectural success the roof calls for characteristic treatment by a trained organization experienced in roof Architecture and with an intimate knowledge of the possibilities connected with the slate produced and available in the Vermont and Pennsylvania quarries.

Many interesting and artistic effects in standard thickness slate can be produced by the mixing of various color tones provided care is taken in the harmonizing of the colors and the application of the slate so as to avoid the clashing of unfriendly colors or creating a checkerboard appearance which so frequently results in artistic failure and consequent disappointment.

The slate used may be limited to a single length in random widths or in graduated lengths and exposures which if correctly balanced produces a distinctive and individual effect although lacking the surface texture and depth of shadow so characteristic of the heavier thickness slate. By the intermixing of heavier slate a rougher and more textural appearance can be secured without undue increase of cost.

The color tones we introduce in this type of roof consist of varying shades of Grey, Weathering Greens, Rustics, Purples and Black--this combination when intelligently distributed in application gives a roof of dark general tone that after a few months exposure to allow of "weathering" brings out the final coloring, which is very distinctive and pleasing.

Where graduated lenghts are specified it is necessary to have access to the Architects plans in order to determine the exact quantities required in each length and to prepare a layout for the guidance of the roofer in applying the slate--this service we render through our Architectural Department, 103 Park Avenue, New York City.

This house at Broadway, England, is perhaps the finest example of Cotswold architecture

Applying the Cotswold Style to America

Excerpt by permission from an article in "Country Life" written by Mr. Alfred Hopkins, Architect, New York

IN the scramble of our domestic building, my mind loves to revert to that peaceful and perfect architectural picture which greets the eye of the traveler in the rural districts of England, and particularly among the Cotswold hills of England.

Transplanting Cotswold to Connecticut, Pennsylvania, Ohio or Michigan is a delightful and absorbing task. In this transplanting of an old style into a new environment, certain principles must be observed in the adapting of the Cotswold type of design to the American home. The artistic principle on which the Cotswold buildings are composed is simplicity—simplicity of design, simplicity of material. The former is important, but for the moment I emphasize the latter. Simplicity of material means that, barring the glass in the windows and the wood in the doors, the entire exterior of the structure is carried out in stone.

I have given you an inkling of what the Cotswold walls are like, so I will come again to the roofs, and gladly, too, for I never grow weary of writing or talking about them. And, because they are so beautiful and so simple, I say the same thing over and over again. I always say that their beauty lies in their roughness, which is because the units are irregular and small; that in reproducing them our slate must be small, too; that our quarrymen still have much to learn about this sort of slate, and they acquire knowledge slowly; that we must graduate our slate courses, a pretty custom that is centuries old in England but, so far as I know, never practiced here until recently; that these graduated courses must run from four inches at the eaves to two inches at the ridge. All these things I have to say, because they are necessary to good roofing. Then there is the broad band at the ridge; and the ridge is vital, for it bounds the silhouette, and the outlines in all pictorial arts are difficult and important. The beautiful shadows of rounding surfaces soften the sculptor's work, and the painter has developed many ingenuous tricks for blending the point of contact between one plane and another. So the ridge of the roof is vital, and the Cotswold ridges, like the sculptor's outlines are rounding and soft and never run to a straight line.

NOTE:—Mr. Hopkins has introduced the "Cotswold" type of Architecture in several of his recent residential designs. Interesting examples are the Residences of Mr. F. R. Huntington, Columbus, Ohio; Mr. H. Gilbert, Bowmansville, Pa.; Mr. J. W. Lawrence, Pittsburgh, Pa.; and Mr. H. Ledyard, Grosse Point, Mich., the latter of which is illustrated on the opposite page.

In each instance the roof is of Penrhyn Stone in small sized units and varying in color but of a dark general tone of weathered effect in thorough harmony with Cotswold Architecture.

Section of roof of Ledyard Residence showing effective use of small units of Slate

Residence of H. LEDYARD, Grosse Point, Mich. — *Alfred Hopkins, Architect*

Commercial Grades of Roofing Slate

THE following is a complete classification of the various grades of roofing slate obtainable in standard thickness (3-16"). The Blue-Grey Slates are produced exclusively in the Pennsylvania quarries and the various colored slates are quarried in the State of Vermont and in New York State on the border line of Vermont.

Slate of standard thickness is produced from beds that allow of a comparatively smooth surface only--where a rough surface texture is desired recourse must be had to heavier thicknesses from quarter inch up to an inch or over which are classified as "Architectural Slate" and mainly specified in graduated thicknesses and lengths.

VERMONT COLORED SLATES

VERDELITE UNFADING GREEN

Verdelite Unfading Green is of a shade of green that is not only uniform and positively unfading, but has none of the dullness or grey color so characteristic of all other so-called unfading greens. When first laid on the roof it is a light green, but it soon assumes a uniformly dark rich green that is permanent and unchangeable in color.

WEATHERING GREEN

A Green-Grey Slate of excellent quality and texture, an uncertain percentage of which after exposure on the roof for a short period will develop into varying shades of Buff, Brown and Yellow. Whilst the degree or nature of the color change is not pre-determinable, this very quality when used intelligently in mixture is very valuable in producing a roof effect of decidedly warm color.

MOTTLED GREY

A greenish Grey Slate of excellent quality and good texture with streaks or mottlings of darker grey. This interesting Slate is especially adaptable and is recommended for use in connection with the Colonial type of architecture and for this reason is often referred to as "Colonial Grey"--properly classified as of an unfading color. Mottled Grey is also of great value in combination with Purples and Weathering Greens for roofs where mixed color effects are desired.

VARIEGATED GREEN AND PURPLE

An unfading Slate in which the Purple and Green is beautifully blended that it resembles an Opal in appearance. The different beds of the quarry from which this Slate is obtained vary in shadings; generally speaking there are two classifications—light and dark. This Slate has remarkably good texture and the quality is excellent; it makes a beautiful roof without any other mixture but blends well in a mixture of dark Grey and Unfading Green.

DARK MOTTLED PURPLE

A deep rich Purple in which slight markings of Green appear, and one of the few Purple Slates that retain their original color. For this reason it is exceptionally valuable in mixture.

SEA GREEN

Commercial term for a Greyish Slate produced in the Granville (New York) district. The name is somewhat misleading as it is not Green and the color fades variably on exposure and may cause disappointment unless used in mixture. It has a much smoother surface texture than other colored Slates.

NOTE:—This list is confined to Slates procurable in standard thickness. Other colorings are available in "Penrhyn Stone" mixtures for Architectural roofs in graduated thickness.

PENNSYLVANIA BLUE-GREY SLATES

GENUINE BANGOR

A rich Blue-Grey Slate of high quality produced in two grades.

NO. 1 CLEAR

Uniform surface, even thickness, approximately 3-16″, with full corners and clear stock.

NO. 1 RIBBON

Produced from the same beds as No. 1 Clear, but portions of the Slate contain dark streaks or markings which are entirely hidden when the Slate is laid on the roof with the regulation three-inch head lap. The Slate is high grade and presents the same appearance when laid, as a roof of the selected No. 1 Clear Slate. Specified by U.S. Government for the roofs for the most of the large Veterans Hospitals erected in recent years.

GENUINE ALBION

Produced in the Pen Argyl region of Pennsylvania and usually offered under the classification of Albion-Bangor. Slate produced from the Genuine Albion veins is a good quality Slate and can be recommended where a less expensive Slate than Genuine Bangor is desired. Unfortunately many quarries not operating on the Albion Vein offer an inferior product under this classification and care should be exercised in specifying "Genuine Albion."

FRANKLIN BIG BED—FRANKLIN TUNNEL—WASHINGTON BIG BED

This Slate is produced in the Slatington region of Pennsylvania and on roofs of large area it is unequalled, owing to the absence of varying shades of tone in the color effect—this is due to the large size of the beds of slate from which it is produced.

ROUGH CLEFT BLUE-GREY SLATE

Until recently the use of a Blue-Grey Slate was confined to smooth surfaced material of standard thickness but the demand of the Architectural profession for a rough textured Slate of Architectural quality has become insistent.

To meet this demand we are producing a rough cleft Slate in thicknesses from ¼″ to 1″ and in varying lengths and widths for graduated exposures. Many leading Architects are specifying this Slate for roofs of graduated lengths and thicknesses as well as in mixture with other colors of Penrhyn Stone of a rough texture.

THE following Slate Roofs along with others have recently been supplied by the J. W. Williams Slate Company. The roof layout was prepared by the Architectural Service Department from the Architect's plans and specifications.

Name	Location	Architect
Eben S. Church, Residence	Bedford, N. Y.	Randall Henderson
Col. H. H. Rogers, Residence	Southampton, L. I.	John Russell Pope
Giles K. Tinker, Residence	Oyster Bay, L. I.	Polhemus & Coffin
E. D. Adams, Residence	Rumson, N. J.	Simpson & Rolston
Geo. A. Bomann, Residence	Scarsdale, N. Y.	Geo. F. Root, 3rd
H. W. Lowe, Residence	Wheatley Hills, L. I.	John Russell Pope
Prof. John Erskine, Residence	Wilton, Conn.	Moore & Woodbridge
Geo. A. Licht, Archt., Residence	New Rochelle, N. Y.	Geo. A. Licht
Geo. R. Thompson, Archt. Residence	Hempstead, L. I.	Geo. R. Thompson
S. Forry Laucks, Residence	Wrightsville, Pa.	Delano & Aldrich
D. Raymond Edgar, Residence	Metuchen, N. J.	H. H. Wheeler
D. W. Dilworth, Res. & Garage	Locust Valley, L. I.	J. H. DeSibour
Dr. O. H. Leber, Residence	Montclair, N. J.	William G. Killian
Mrs. J. E. Linde, Residence	Red Bank, N. J.	Lyon & Taylor
P. H. Burnett, Residence	Woodbury, L. I.	Alfred R. Wittich
R. O. Lipton, Residence	Westfield, N. J.	D. Wentworth Wright
Edwin S. Isham, Residence	Brielle, N. J.	John B. Peterkin
Hubert E. Rogers, Residence	Scarborough, N. Y.	Delano & Aldrich
L. Suffern Tailer, Residence	Rumson, N. J.	Polhemus & Coffin
A. D. Barney, Residence	Farmington, Conn.	Heathcote M. Woolsey
J. W. Lawrence Gate Lodge	Pittsburgh, Pa.	Alfred Hopkins
Gelston B. Morris, Res. & Garage	Briarcliff Manor, N. Y.	Almus P. Evans
Col. J. Mayhew Wainwright, Residence	Rye, N. Y.	Woolsey & Chapman
Lewis E. Stoner, Residence	West Hartford, Conn.	Malmfeldt & Prentice
O. K. Perry, Residence	Interlaken, N. J.	Stanley & Wheeler
W. J. MacLaughlin, Residence	Montclair, N. J.	Frank H. Vreeland
Julius L. Sussman, Residence	Great Neck, L. I.	Arthur W. Coote
Edw. Ingraham, Residence & Garage	Bristol, Conn.	Richard H. Dana, Jr.
Jas. F. McClelland, Residence	Greenwich, Conn.	Richard H. Dana, Jr.
Arthur A. Hartmann, Residence	Brightwaters, L. I.	Lawler & Haase
Mrs. John R. McGinley, Residence	Princeton, N. J.	Rolf William Bauhan
W. J. Donovan, Residence	Peekskill, N. Y.	Chester A. Patterson
Wm. Lawson, Residence	Mamaroneck, N. Y.	E. D. Parmelee
Judge W. D. Van Riper, Residence	West Orange, N. J.	Hobart A. Walker
Chas. M. Chapin, Residence	Bernardsville, N. J.	Delano & Aldrich
W. S. Griswold, Residence	Hartford, Conn.	Walter P. Crabtree
Col. Jacob Ruppert, Residence	Garrison, N. Y.	Maynicke & Frank
Mrs. Maria Van Wagner, Residence	Roselle, N. J.	D. Wentworth Wright
C. E. Reeb, Residence	Westfield, N. J.	D. Wentworth Wright
Bernard Residence	Pasadena, Calif.	Morgan, Wells & Clements
Greenhouses for Miss Marion Davies	Beverly Hills, Calif.	
Felix Warburg, Residence	White Plains, N. Y.	Arnold Brunner, Ass.
Hewlett School	Rockville Centre, L. I.	Huse T. Blanchard
Miss Chapin's School	New York City	Delano & Aldrich
Golf Club House, Silver Lake Park	Tompkinsville, S. I.	Sibley & Fetherston
Mead Memorial Chapel	Lake Waccabuc, N. Y.	Hobart Upjohn
First Church of Christ Scientist	Great Neck, L. I.	Robert Tappan
Mr. and Mrs. J. Atkin, Residence	Pasadena, Calif.	Paul R. Williams
Eddie Cantor, Residence	Great Neck, L. I.	A. F. Gilbert
Greenwich Country Club	Greenwich, Conn.	Wm. F. Dominick
Grade & High School	King's Park, L. I.	Tooker & Marsh
Frank H. Davis, Residence	Montclair, N. J.	Clifford C. Wendehack
Tuberculosis Hospital	Farmingdale, L. I.	Jallade & McKenna
Mr. & Mrs. G. Edward Leh, Residence	Allentown, Pa.	Tilghman Moyer Co.
Sir Thomas Tait, Residence	St. Andrews, N. B., Canada	Maxwell & Pitts, Montreal
Harry Sirkin, Residence	Jamaica Estates, L. I.	Hunt & Kline
Great Meadows Prison	Comstock, N. Y.	Wm. E. Haugaard
Grade & High School	Long Beach, L. I.	Howard Leland Smith
Charles H. Hoch, Residence	Allentown, Pa.	Jacoby & Everett
Jos. Leonard, Residence	Allentown, Pa.	C. M. Lovelace
Roswell Miller, Residence	Millbrook, N. Y.	Almus P. Evans, N. Y.
C. H. Veeder, Residence	Hartford, Conn.	Brooks, Glazier & Adams
Oscar Hammerstein, II, Residence	Great Neck, L. I.	Hunt & Kline, N. Y.
F. R. Huntington, Residence	Columbus, O.	Alfred Hopkins, N. Y.
H. Ledyard, Residence	Grosse Point, Mich.	Alfred Hopkins, N. Y.
H. Gilbert, Residence	Bowmansdale, Pa.	Alfred Hopkins, N. Y.

Name	Location	Architect
F. C. Goode, Residence	Larchmont, N. Y.	Kenneth Watkins
Dr. R. Blum, Residence	Harrison, N. Y.	S. D. Eisendrath
J. C. Clark, Residence	Bernardsville, N. J.	Delano & Aldrich
Arthur E. Jones, Residence	Summit, N. J.	Geo. E. Jones
Mrs. F. E. Tupper, Residence	Montclair, N. J.	Holmes & Von Schmid
L. N. Creighton, Residence	Montclair, N. J.	Donald Anderson
Dr. Bernheim, Residence	Greenwich, Conn.	Frank E. Newman
James D. Skidmore, Residence	Short Hills, N. J.	Rossiter & Muller
Richard Liggett, Residence	Litchfield, Conn.	Richard Dana, Jr.
H. T. Fleitman, Residence	Brookville, L. I.	James W. O'Connor
Chas. Blackwell, Residence	Brookville, L. I.	Polhemus & Coffin
Allan Mann, Residence	Scarsdale, N. Y.	Electus Litchfield
Jansen Noyes, Residence	Fishers Island, N. Y.	Frank E. Newman
Alfred G. Smith, Residence	Greenwich, Conn.	W. F. Dominick
W. B. Goodwin, Residence	Hartford, Conn.	Benj. Morris
C. Allen Hudson, Residence	Rumson, N. J.	Polhemus & Coffin
Lester A. Bassett, Residence	Great Neck, L. I.	Lester A. Bassett
Justin B. Ward, Residence	Irvington-on-Hudson	Delano & Aldrich
George R. Pensel, Residence	Amsterdam, N. Y.	Fuller & Robinson
Dr. McFadden, Residence	Shelbyville, Ind.	Frank B. Hunter
Edward L. Taylor, Residence	Williamsport, Pa.	Ornan H. Waltz
J. R. Ellis, Residence	Memphis, Tenn.	J. R. Ellis
Geo. Fitzmaurice, Residence	Beverly Hills, Calif.	Roy Seldon Price
Chas. & Al. Christie, Residence	Beverly Hills, Calif.	Leland F. Fuller
Arthur Letts Est., Residence	Holmby Hills, Calif.	Arthur Kelly
Geo. A. Morrell, Residence	Ottumwa, Iowa	Tunsley & McBroom
Warren, Residence	Summit, N. J.	Forman & Light
Staats, Residence	Los Angeles, Calif.	Marston, VanPelt & Maybury
J. Hancock, Residence	Beverly Hills, Calif.	Jos. M. Savage
J. F. Potter, Residence	Hollywood, Calif.	Nat Coleman
O. B. Englisch, Residence	Los Angeles, Cal.	Arthur Kelly
Armand Chevalier, Residence	Senville, P. Q.	J. Cecil McDougall
N. Y. City School No. 32	Eltingsville, S. I.	W. H. Gompert
Newman School	Lakewood, N. J.	Richard H. Dana, Jr.
N. Y. City School No. 38	Rosedale, L. I.	W. H. Gompert
Edgemont School	Montclair, N. J.	Starret & VanVleck
St. Teresa's School	North Tarrytown, N. Y.	Knappe & Morris
South Orange High School	South Orange, N. J.	Gilbert & Betelle
Roosevelt School	Montrose, N. Y.	Knappe & Morris
Nutley High School	Nutley, N. J.	Gilbert & Betelle
Hibberd School	Richmond, Ind.	Perkins, Fellows & Hamilton
Russell School	Los Angeles, Calif.	Orville L. Clark
Second Street School	Los Angeles, Calif.	C. M. Hutchison
Wilmington High School	Los Angeles, Calif.	Austin & Ashley
Brescia Hall Dormitory	New Rochelle, N. Y.	McGill & Hamlin
Bloomfield Library	Bloomfield, N. J.	John F. Capen
Olin Memorial Library	Middletown, Conn.	McKim, Meade & White
Fishers Island Golf Club	Fisher's Island, N. Y.	Parsons & Wait
Miriam Osborne Home	Rye, N. Y.	Crow, Lewis & Wick
Yountakah Country Club	Nutley, N. J.	C. Wendehack
Peekskill Military Academy	Peekskill, N. Y.	Frank A. Moore
W. J. Z. Radio Corp. America	Bound Brook, N. J.	Clinton McKenzie
W. E. A. F. Radio Corp. America	Bellmore, L. I.	Clinton McKenzie
Hi-Power Receiving Station	Belfast, Me.	Clinton McKenzie
State Homeopathic Hospital	Middletown, N. Y.	Sullivan Jones
State Insane Asylum Buildings	Asyla, N. J.	Walter W. Sharpley
Nurses Home	Tompkinsville, S. I.	Delano & Aldrich
N. Y. Central Station	West Point, N. Y.	N. Y. C. Eng. Dept.
Nathan Littauer Hospital	Gloversville, N. Y.	Crow, Lewis & Wick
St. Michael's R. C. Church	Jersey City, N. J.	Reroofed
St. Patrick's R. C. Church	Jersey City, N. J.	Reroofed
St. Peter's R. C. Church	Jersey City, N. J.	Reroofed
Simpson Grace M. E. Church	Jersey City, N. J.	Chas. G. Jones
First Baptist Church	Plainfield, N. J.	Hobart Upjohn
Morrow Memorial Church	Maplewood, N. J.	F. Y. Parsons
First Church of Christ Scientist	Montclair, N. J.	Chas. B. Faulkner
M. E. Church	Farmingdale, L. I.	Julius Gregory
Hyde Park M. E. Church	Cincinnati, Ohio	Grange, Lowe & Bollenbacher
St. Rose Church	Belmar, N. J.	J. O. Rourke
Church of the Redeemer	Morristown, N. J.	Wesley S. Bessell
Chapel, Women's College of N. J.	New Brunswick, N. J.	State Architect
St. James Church	Los Angeles, Calif.	
W. R. Weldon, Residence	Pasadena, Calif.	Gilbert S. Underwood, Archt.
Thomas R. Cox	Englewood, N. J.	Polhemus & Coffin, Archts.

SPECIFICATIONS *for* GRADUATED SLATE ROOFS

GENERAL AND GUARANTEE

(a) The Roofing Contractor shall furnish all the materials and labor in accordance with the drawings and these specifications.

(b) This contractor shall inspect all surfaces prepared for slating by other trades, point out to the proper authority any defects, and shall not proceed with the laying of felt, flashings, or slate until such corrections that may be necessary have been made.

(c) The Roofing Contractor shall furnish his own scaffold or rigging, or arrange with the General Contractor for the use of scaffolds furnished by others.

ROOFING FELT

(a) On all boarding to be covered with slate, lay asphalt saturated rag felt, not less in weight than that commercially known as "30 pound" felt.

(b) Felt shall be laid in horizontal layers with joints lapped toward eaves and at ends at least 2″ and well secured along laps and at ends to properly hold the felt in place and protect the structure until covered by the slate. All felt shall be preserved unbroken, tight and whole.

(c) The felt shall lap over all hips and ridges.

(d) Felt shall be lapped 2″ over the metal of any valleys or built-in gutters.

HIPS

All hips shall be (mitred, boston, saddle or fantail)

RIDGES

All ridges shall be strip saddle type with butt joints.

VALLEYS

Valleys shall be (open, closed or rounded)

ELASTIC CEMENT

Cement shall be an approved brand of waterproof elastic slater's cement colored to match as nearly as possible the general color of the slate.

NAILS

(a) All slate shall be fastened with large flat-head slater's copper nails of sufficient length to adequately penetrate the sheathing. Care should be taken to avoid exposing the nails on cornice, soffits, overhanging eaves, etc.

(b) Nails securing slate must in no instance be driven through flashing.

SLATING

(a) The entire surface of all main and porch roofs, the roofs and sides of any dormer windows (if shown) and all other surfaces so indicated on the drawings, shall be covered with PENRHYN STONE in varied color tones as furnished by the J. W. WILLIAMS SLATE CO., 103 Park Ave., New York City, in thicknesses ranging from to not less than ¼″ in a combination of sizes as shown on layout to be furnished by the slate producer and approved by the Architect.

(b) Slate to range in length from at the eaves with exposure to at ridge, with exposure. The different thicknesses of slate are to be intermixed in each course in accordance with the schedule as shown on layout in order to produce an interesting textural effect by the contrasting thicknesses.

(c) The slate shall project at the eaves and at all gable ends as directed, and shall be laid in horizontal courses with the standard 3″ headlap, and each course shall break joints with the preceding one. Slates at the eaves or cornice line shall be doubled and canted so that the succeeding course will have flat contact.

(d) Slates overlapping sheet metal work shall have the nails so placed as to avoid puncturing the sheet metal. Exposed nails shall be permissible only in top courses where unavoidable.

(e) Neatly fit slate around any pipes, ventilators, etc.

(f) Cover all exposed nail heads with elastic cement. Hip slates and ridge slates shall be laid in elastic cement spread thickly over unexposed surface of under course of slate.

(g) Build in and place all flashing pieces furnished by the sheet metal contractor and co-operate with him in doing the work of flashing.

(h) On completion the roof shall be left in every respect tight and a neat example of workmanship.